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Article

Development of The Electric Power Industry of Uzbekistan: State, Main Reserves, Ways of Utilization

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Abstract: A stable and contemporary electric power sector is essential to Uzbekistan's ongoing economic growth. Notwithstanding continuous improvements, the energy sector in Uzbekistan still faces structural, technological, and financial difficulties, such as antiquated infrastructure, inefficiencies, and growing demand that exceeds supply. Although there has been discussion of modernization plans, systemic reserve identification has not been fully integrated with workable suggestions for long-term sectors transformation. The goal of this study is to pinpoint the electric power sector's key reserves and create workable ideas for enhancing its sustainability, investment appeal, and efficiency. According to the study, there are substantial reserves in the areas of strategic management, energy efficiency, public-private partnerships, technical upgrading, and the growth of renewable energy. Upgrading infrastructure and putting ideas into practice can increase output, lower losses, and draw in private investment. The report, which was created especially for the Uzbek context, introduces a dual approach to reserves, both domestic and foreign, and highlights strategic shifts toward resource-innovative development and digital transformation. These insights help national energy strategy by offering a roadmap for increasing the industry's competitiveness, environmental sustainability, and financial stability. To implement these reforms, a large investment, a restructured asset portfolio, and the integration of smart grid technology are required. The findings support a shift toward a competitive power market and highlight the need of reducing reliance on antiquated equipment and fossil fuels.

Keywords: Reserves, Management, Fixes Assets, Alternative Energy Sources, Hydroelectric and Thermal Power Plants, Production Costs, Investments, Profit

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1. Introduction

Today, the sustainable development of electric power enterprises is the basis for the effective organization of the national economy and ensuring its stability, which is one of the most important conditions for the development of modern Uzbekistan. At the same time, the standard of living of the population and the efficiency of other sectors of the economy largely depend on the stable operation of enterprises in the electric power industry, and for this reason, energy security and energy efficiency are the main strategic goals of the state's energy policy [1].

The development strategy of the new Uzbekistan for 2022-2026 sets the goal of uninterrupted provision of the economy with electricity, active implementation of "green economy" technologies in all spheres, and increasing the energy efficiency of the economy by 20 percent [2].

Uzbekistan has made significant progress in this area in recent years as a result of market dynamics, technological advancements, and economic reforms. The industry's trajectory has been altered by government programs to modernize energy infrastructure, increase energy efficiency, and diversify the energy balance, setting it up for long-term growth and development. But in spite of these initiatives, the energy sector still faces a number of issues that call for locating reserves and defending the methods by which they might be used to create a stable, effective, and dependable power supply system in our nation [3].

2. Materials and Methods

The goal of our research is to determine the main reserves for the development of the electric power industry in Uzbekistan and to substantiate proposals for their use. At the same time, the object of research is the electric power industry of Uzbekistan. In turn, the subject of research is the economic relations arising in the process of production and economic activities of electric power companies aimed at improving the mechanism for increasing development efficiency. In the study, the electric power industry is considered as a system that consists of constituent elements, internal and external connections are identified that most significantly affect the studied results of its functioning, and on this basis, the main reserves for the development of the industry and ways to engage them in practice are identified [4].

The starting point in the functioning of an enterprise in the energy industry is to increase the efficiency of their work. This is due to the fact that the basis for the successful functioning of enterprises is to increase the efficiency and effectiveness of its work. On the other hand, to achieve operational efficiency, it is necessary to activate all available reserves of the enterprise, while to assess the effectiveness of the enterprise's activities, an economic analysis of the enterprise's functioning is carried out and reserves are identified to improve it [5].

The concept of reserves is understood in two senses: as a stock of resources to ensure the smooth operation of production and as opportunities for the development of production. Production reserves are understood as unused production opportunities to increase production efficiency by increasing volumes and improving product quality, as well as through the most rational and optimal use of resources. This definition is given from the point of view of the internal environment of the company. The concept of reserves requires a two-sided approach, that is, from the point of view of internal and external capabilities of the enterprise. Because in a market economy, an organization is always considered an open system, that is, it is open to the external environment [6].

Enterprise reserves represent a segment between the point of actual resource use and potentially available. At the same time, the segment between the point of actual resource use and the point reflecting the available resource potential of the enterprise represents the internal reserves of development, and the segment from the point reflecting the available resource potential of the enterprise to the point of available resources is the external reserves of the company [7].

In recent years, the system of state regulation of the electric power industry in Uzbekistan has changed, the electricity market has formed, and instead of the former vertically integrated companies, structures specializing in certain types of activities have been created. In accordance with the Decree of the President of the Republic of Uzbekistan of March 27, 2019 "On the strategy for further development and reform of the electric grid complex of the Republic of Uzbekistan", the electric power industry is divided into three areas: production, transmission, and distribution.

Implementing generating projects on a radically new paradigm for the Uzbek energy sector public-private partnership was one of the successful stages on the route to market relations in the energy industry. PPP projects are carried out through a bidding process.

In recent years, efforts have been made to update existing hydroelectric and thermal power plants by installing equipment and introducing new technologies based on the most recent advancements in energy efficiency. Specifically, power production rose by 38% to 81.5 billion kilowatt-hours between 2017 and 2024 alone. The improved capability of the private sector resulted in the production of 11.2 gigawatts of new capacity. This resulted in a 24 percent private sector share in generation and a 16 percent "green" energy share. Household earnings climbed by 1.6 times during this time, while the usage of new household appliances led to a 21 billion kilowatt-hour rise in household power use. This is double what it was in 2016 [8].

Therefore, it can be said that while Uzbekistan's electric power industry developed between 2017 and 2024, several steps were taken to modernize the sector, enhance its structure, and improve its technical and technological status of production and management system. But even with these improvements, there are still a lot of issues with the energy sector's growth that must be resolved immediately.

Expert research indicates that the national economy's energy intensity is currently two to three times higher than that of industrialized nations. In Uzbekistan, the housing sector is responsible for 40% of energy use, compared to roughly 23% globally. Specifically, Uzbekistan consumes more than 390 kWh of energy annually per square meter, whereas Europe consumes 120–150 kWh. In 2020, 917.5 million kWh of electricity and 1,352.4 million cubic meters of natural gas were saved in the economic sectors as a result of efforts to increase energy efficiency through the execution of organizational and technological measures. As a result, the nation's energy efficiency is inadequate [9].

In Uzbekistan, the demand for electricity is steadily growing, in particular, since 2019, the demand for electricity has begun to increase by 3 percent from the supply. At the same time, electricity production is growing at a lower percentage (an average of 2.5-2.7 percent) compared to the growth of the republic's GDP (an average of 5-6 percent). Electric power capacities in the country cannot meet the growing need for electricity. The electricity deficit is covered by imports from neighboring countries, in particular, 64 percent from Turkmenistan, 20.3 percent from Tajikistan, 11.3 percent from Kazakhstan, and 4.4 percent from Kyrgyzstan.

The shortage of electricity and gas in Uzbekistan is the result of a number of problems. In particular, the energy system has not been privatized, and there is a state monopoly in the sphere. In addition, the systems are technically outdated. Most of the equipment was commissioned back in the 60-70s of the last century. The problem of obsolescence of installed equipment is particularly acute in thermal power and hydropower. In particular, the share of obsolete fixed assets in the JSC "Uzbekenergo" system (operated for more than 30 years) is 62.4%. The majority of contemporary electrical networks, comprising 50% of transformers, 66% of trunk networks, 62% of distribution networks, and 74% of substations, have a service life of more than 30 years. Consequently, the average energy loss in distribution networks is 12.5%, whereas in trunk networks it is 2.72 percent. Additionally, the current lack of regulating capabilities results in more thermal power plant units restarting every day, which increases fuel consumption and wears down technological equipment. Large electricity losses due to outdated infrastructure make up over 20% of all electricity produced.

The industry's production costs continue to be high due to the high energy intensity and physical and moral wear of the majority of the equipment. The idea of high electricity production costs is theoretically supported by the fact that the country's gross domestic product's energy intensity is currently double the global average. Businesses' financial health suffers as a result of this circumstance. One element that lowers the amount of profit obtained is the high cost of production, which consequently lowers the company's undistributed profit. Since retained earnings are known to be reinvested in a joint stock company's output, lowering them will result in a decrease in the amount of internal

investments (savings) made by joint stock businesses in the sector. At the same time, significant investments are needed for equipment renewal and industrial modernization. Investment serves as the foundation for the growth of any contemporary business in a market economy.Reducing the electric power industry's environmental impact is one of its most urgent issues. The production of power using conventional fossil fuels increases greenhouse gas emissions, which exacerbates climate change. Pressure to switch to cleaner, renewable energy sources like wind, solar, and hydroelectric electricity is therefore increasing.

3. Results

Consideration of the electric power industry in modern conditions reveals a multifaceted landscape characterized by both challenges and prospects. Through comprehensive analysis, reserves for the development of the industry have been identified, the use of which will directly affect the current state and future trajectory of the industry. At the same time, certain reserves of organizational, technical, economic, and social nature have been determined.

A reserve for the growth of the electric power sector is the shift from resource-raw material to resource-innovative development. In order to put this reserve into effect, it is required to: implement management innovations based on new principles that are fundamentally different from traditional management methods; make sure that innovations are systematic in nature and encompass a wide range of methods and processes; and establish the conditions necessary for the implementation of innovations that eventually result in improvements to become a part of an ongoing process.

One of the main problems in the electric power industry today is the physical and moral obsolescence of most of the equipment. To eliminate this problem, it is advisable to carry out the following work:

a. Introduction into the network of modern innovative technologies and equipment that allow saving fuel and energy resources and reducing the impact of energy production on the environment;
b. Completing work on power plant rebuilding, modernization, and technical re-equipment to boost capacity and enhance technical and economic indicators with the goal of preserving installed capacity under particular economic circumstances.

At the same time, it is the modernization of the industry that acts as a powerful reserve for the development of the electric power industry. Modernization aimed at increasing production potential based on innovations, the introduction of modern equipment, technologies, and methods of producing competitive products, reduces the financial costs of the energy company, increases the volume of output, and ultimately will improve production efficiency.

Infrastructure modernization in accordance with modern standards is an expensive undertaking that requires significant investment and strategic planning.

Consequently, the implementation of the above activities requires investment for their implementation. The energy sector needs investments in the amount of 25-30 billion dollars. This can only be achieved by attracting private investment. To do this, it is necessary to interest potential investors by ensuring the attractiveness of companies for investment. To increase the investment attractiveness of energy companies, it is necessary to carry out a set of measures to restructure the assets of the enterprise, i.e., to carry out a set of measures aimed at changing the structure of the company in order to increase its efficiency and ensure sustainable development. At the same time, firstly, the measures should cover all components of the company's property structure (non-current assets, current assets, cash, and financial investments). Secondly, analyze in detail all technical and economic indicators, the level of turnover of available assets, the real return on capital, the level of financial stability, and liquidity of assets [10].

It is possible to lower overall energy usage, lessen the strain on the network, and lower consumer costs by investing in energy-efficient equipment, encouraging conservation measures, and boosting demand response initiatives. Innovations in energy storage technology have the potential to revolutionize the electric power sector. To realize these opportunities, research and development focused on enhancing energy storage's accessibility and efficiency is essential.

By introducing innovations in the management of current joint-stock companies, the electric power industry may secure its long-term dominance in the market, which is one of the reserves for its expansion. To advance, the sector must shift to strategic management, which will allow businesses to accomplish their objectives while making the best use of available resources. At the same time, enhancing energy efficiency and putting demand management plans into place are essential elements of the electric power sector's sustainable growth [11].

The relevant tasks remain to increase the level of energy saving, reduce the cost of electricity generation by forming a competitive electricity market. One of the reserves in this direction is the further implementation of generation projects on a fundamentally new model - public-private partnership. The peculiarity of PPP is that the private partner must operate the facility. And if he has to operate it, then he builds it in such a way that he will not have problems in the future.

The peculiarity of the electricity market lies in the continuous process of production and consumption over time, which can serve as a reason for vertical restrictions on access to energy networks for buyers who are not included in agreements with suppliers. This problem is especially significant when the capacity of the wholesale electricity supplier is not enough to cover current needs. In this case, a situation arises when the seller of electricity gets the opportunity for price discrimination on residual demand [12].

Determining the phases of the shift to a competitive market system while accounting for foreign experience, researching market regulations, and creating a comprehensive idea in this regard are all important for this. Simultaneously, the transformation process's primary objective is to address issues with station modernization, energy efficiency, service quality, and guaranteeing competitive prices for goods, specifically for heat and electricity energy. It is necessary to use the experience of other nations while transforming businesses. Expanding the scope of digital technology implementation is also crucial. When digitization and automation are used, the network becomes more stable and adaptable to changing circumstances [13].

The advent of "green energy" serves as a buffer for the growth of the sector that results in higher energy efficiency. Making the switch to renewable energy sources improves sustainability and energy security while also lessening the impact on the environment. In order to optimize system efficiency and accommodate an increasing proportion of renewable energy, electrical networks must be modernized and made more flexible. Demand response, decentralized energy generation, and more effective network operation are made possible by smart grid technology, sophisticated sensors, and real-time data analytics.

4. Discussion

Today, the main problems of energy are related to the increasing growth of the Earth's population, energy shortages and limited fuel resources, and increasing environmental pollution. The most important tasks are to maximize possible savings and rational use of all types of resources, increase the efficiency of power plants and introduce new methods of generating electric energy. Electricity production has been undergoing major changes in recent years: fossil energy sources are being viewed more critically due to their carbon dioxide balance and dwindling reserves. And this is despite the fact that more than 80% of the modern energy supply is based on non-renewable energy sources.

Nuclear energy is being questioned as an alternative for safety reasons, in particular after the reactor accident in Japan [14].

In some countries, attempts are being made to give tangible benefits to renewable energy sources and stimulate their development through the adoption of government programs or tax breaks. It should be noted that over the next decades, a significant increase in energy consumption is expected due to economic development and population growth. This will lead to an increase in economic activity ahead of energy consumption, increase pressure on the energy supply system and require increased attention to energy efficiency. Obviously, no mode of saving non-renewable energy sources is able to exclude the moment in the future when they will be completely exhausted [15].

When managing the operation of the energy system, when forecasting and designing its development, as well as conducting scientific research, it is necessary to take into account the mutual influence of the energy system, related farming systems and the biosphere. The development of energy has a direct impact on the overall level of technology development. In turn, advances in various fields of technology are reflected in the state of energy. Energy, the biosphere, and social and economic human activities are interconnected [16].

Their effects on the biosphere are a key distinction between renewable and non-renewable energy sources. Additional heating of the habitat results from the addition of energy from non-renewable sources to the planet's natural heating energy, which is supplied by the sun. Since the utilization of renewable energy sources does not contribute to global warming, it is referred to as non-dilutive energy. In fact, by directing the sun's beams into Earth-based power plants, for instance, we extract energy from the planet's heating cycle and then return it to it in the same quantity as before in the form of heat. Non-reducing energy can be called waste-free, adding energy should be considered as polluting the environment.

In this regard, the transition to new sources of electricity, including thermonuclear, thermoelectric, and others, is the only way out of the impasse that is really known. These are the problems of modern energy that need to be addressed right now.

5. Conclusion

According to the research, there are a number of issues facing the growth of the electric power sector, but there are also resources available to address these issues, and using them will help our nation reach a high degree of energy security and efficiency. It is known that the shift to resource-innovative development, innovative strategic management, technical and technological modernization of the industry, building a competitive electricity market, increasing the attractiveness of energy companies for investment, implementing more public-private partnership projects, and intensifying the introduction of "green energy" are all reserves for the growth of the electric power sector.

Therefore, putting the reserves listed in the article into practice will enhance the management system of businesses in the electric power sector. Its adaptability and effectiveness will provide businesses with a sustained competitive edge, which will bolster the economy, draw in foreign capital, modernize fixed assets, increase consumer supply efficiency, and supply a steady supply of electricity to the populace and the overall economy. Uzbekistan would need to produce twice as much power as it does now in order to maintain its energy security by 2030, when the country's electricity demand is expected to rise to 6-7 percent. maintaining the dependability and steady functioning of Uzbekistan's energy system.

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